

ON THE
EXTRACTION OF TEETH:
WITH
AN ACCOUNT
OF
A NEW AND MUCH LESS PAINFUL MODE
OF
OPERATING.

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LONDON:
HENRY RENSHAW, 356, STRAND.

1849.

LONDON :

PRINTED BY A. MUNRO, QUEEN'S HEAD YARD, GREAT QUEEN-STREET,
LINCOLN'S INN FIELDS.

R35540

P R E F A C E.

IN preparing the following pages for the press, my object has been merely to publish such an account of the anatomy of the structures connected with the Teeth, as would serve to illustrate the operation of extraction. The work is consequently, of necessity, a compilation: the best and more recent authorities have been consulted, and TOMES' excellent work laid largely under contribution. In that section of this pamphlet in which the subject of Extraction has been considered, I was more desirous to strengthen my opinion of the injurious consequences which follow the ordinary mode of extracting Teeth—more especially when the key instrument is used—by cases and statements obtained from other sources, than by detailing facts that have come within my own cognizance. The cases I have brought forward amply testify to the truth of my assertions, and as clearly demonstrate that there is something radically wrong in the application of the instruments which are used in the operation, as well as in the manner in which the operation itself is performed. To

remedy this has been my endeavour. The result of my labours has been the invention of the Dental Fulcrum—described in the latter part of my little book—which I have used, and still use, with so much success; and which, I trust, will be found to obviate most, if not all, the disadvantages and difficulties at present met with in the performance of this operation by the key, forceps, or elevator, as well as lessening the pain, &c., &c. The high testimonials which I have received from other practitioners, which fully confirm the results of my own experience, will induce all, I hope, to give it a fair trial, before pronouncing a verdict. I need hardly add, that I shall feel great pleasure in showing the chair to any member of the profession who will favour me with a call.

No. 1, *Suffolk Place, Pall Mall East*,
April 10, 1849.

ON THE

EXTRACTION OF TEETH.

It is indispensably necessary, not only that the surgeon-dentist, but that every person who practises the extraction of teeth, should possess an accurate knowledge of the anatomical structure and physiology of the jaws and teeth. Those who are devoid of this information must of necessity be mere mechanical bunglers—men who may on ordinary occasions perhaps, extract a tooth without causing any severe ultimate mischief, but who, from their utter ignorance, very frequently break the tooth itself, lacerate the gum extensively, or splinter the jaw-bone, and thus lay the foundation for serious and long-standing disease. It is much to be regretted, for the sake of the public who are incapable of distinguishing between the qualified and the unqualified practitioner, that there are persons assuming a title to professional rank to which they have no real claim: this is pre-eminently the case among the surgeon-dentists; added to which, every druggist, especially in country places, holds himself out as a qualified extractor of teeth,

when, in very fact, his ignorance of the anatomy of the parts and of the first principles of surgery, render him incompetent to perform the operation with credit to himself, and advantage to his patient, until he has acquired, at the expense of the unhappy sufferers, a certain amount of experience, as the result of his empirical practice. Mr. Wardroper mentions a country druggist, who made it a matter of boasting that he received about two hundred pounds yearly from the extraction of teeth, his customers being principally the country people who attended the market held in the town, in which he carried on his business. For such men as these, the possession of a few instruments—such as a key, one or two pairs of forceps, and perchance, a punch or elevator, together with a strong wrist and sufficient assurance—constitute an ample stock-in-trade. The records of dental surgery will fully demonstrate the fearful injuries inflicted by such operators on their patients, when they seek to remove, by absolute strength of wrist, a tooth which is difficult to extract. Months of illness and severe bodily sufferings have been the results of their proceedings: nor is the mischief always restricted to the local injury; the general health, especially in feeble or delicate persons, is frequently greatly impaired; and the extraction of a tooth, which, under the hands of a skilful and scientific practitioner, is an operation involving only a moderate amount of pain, and no ulterior bad effects, be-

comes, when badly performed, a cause of very severe injury, and may even induce a disease in the bone in which the tooth was imbedded, which may ultimately require the removal of the jaw, or a considerable portion thereof, by a most painful and dangerous operation. As we have now said enough to point out the importance of an accurate acquaintance with the structures on which the operation is to be performed, we shall proceed to give some account of their anatomy and uses.

The following remarks will be confined strictly to the description of the teeth and their accessory structures, as they are met with in man. For an account of the corresponding structures in the lower orders of animals, the larger works on the teeth must be consulted:—here it would be out of place.

The upper jaw consists of two bones of irregular shape, which, with the exception of the lower jaw-bone, are the largest in the face. Their posterior and upper aspects are very irregular, and they are connected with the bones of the face and skull by the processes they send forth. These assist in the construction of the nose, the orbit, the cheek, and the palate, as their respective names indicate. As our present inquiry, however, is directed to them solely as regards their connection with the teeth, we shall take into consideration that part only in which those important organs are imbedded. The lower and

anterior portion of each bone makes a kind of circular sweep from side to side, the convexity of which is turned forwards; the lower part terminates in a thick spongy edge, cellular in structure, in which are contained the sockets for the teeth; this is called the alveolar process. Extending backwards from this is a plate of bone, which unites with a corresponding plate in its fellow, and together forms the roof of the mouth. The body of the bone is hollowed out into a large triangular cavity, lined with mucous membrane, and is known by the name of the maxillary sinus, or the cavity or antrum of Highmore. The floor of this cavity is marked by several conical projections, indicating the situation of the roots or fangs of the first and second molar teeth.

The lower jaw—unlike the upper, which is fixed—is extremely moveable; and it is its movements, influenced by its muscles, which bring the teeth into action. It constitutes, with its teeth, the whole of the under part of the bony structure of the face. It is much more simple in its form than the upper jaw, and has fewer and less irregular processes. On its upper surface, is placed the alveolar process, corresponding greatly in appearance to that already described as belonging to the upper jaw, and consisting, like it, of a spongy cellular structure, with cavities or recesses for the reception of the fangs of the teeth, but, from the firmer texture of the bone itself, less yielding, and more liable to fracture. It extends

all round the lower part of the bone. The sockets in the alveolar processes of both the upper and lower jaw are thicker and more irregular behind, because the teeth are larger, and have a greater number of fangs. The back teeth in the upper jaw have more fangs than the corresponding teeth in the lower, and their sockets are consequently more irregular. The processes belonging to the lower jaw are the coronoid and the condyloid, which together constitute the upper part of the ascending branch, or portion of bone, which terminates the lower jaw at each side of the face. The coronoid process has attached to it the temporal muscle, while the condyloid serves for the articulation of the jaw with the glenoid cavity of the temporal bone—an articulation admitting of the most extensive movements of the lower jaw upon the upper.

The alveolar processes, as being more intimately connected with the teeth than any other part of the jaw-bones, require a more extended notice than the brief mention already made of them affords. They consist of two thin bony plates, situated on either side of the anterior edge of the upper jaw-bones, and of the upper part of the lower jaw. Between these plates, there are thin, bony divisions, constituting cells or sockets for the reception of the fangs of the teeth, which being more numerous to each tooth posteriorly than they are anteriorly, the cells are also more numerous, and the plates of bone by which the

alveolar processes are formed, are consequently wider apart than they are at the anterior or middle part of the jaw. The cells in which the dental fangs are imbedded, are admirably adapted for that purpose, the root of the tooth fitting to its socket as closely as a finger in a glove, inso-much that the plate of the alveolar process forms furrows or fluting round each cell or cavity, the external plates being depressed at each division or septum. This is observable in the whole length of the alveolar process of the upper jaw, and in the fore-part, particularly, of the lower.

The alveolar processes of both jaws should rather be considered as belonging to the teeth, than as parts of the jaws; for they begin to be formed with the teeth, keep pace with them in their growth and decay, and entirely disappear when the teeth fall; so that, if we had no teeth, it is likely we should not only have no sockets, but not even the processes in which the sockets are formed; as the jaws can perform their motions, and give origin to muscles, without either the teeth or alveolar processes. In short, there is such a natural dependence of the teeth and alveolar processes on each other, that the destruction of the one seems to be always attended with that of the other.

The accompanying engravings illustrate the alveolar processes and sockets of both the upper and lower jaws.



- a a a a* The outer plate of the alveolar process.
b b The inner plate.
c c The ten single sockets for the incisors, cuspidati and bicuspidati.
d d The three double sockets for the molars. The two first have three sockets, and the last only two.

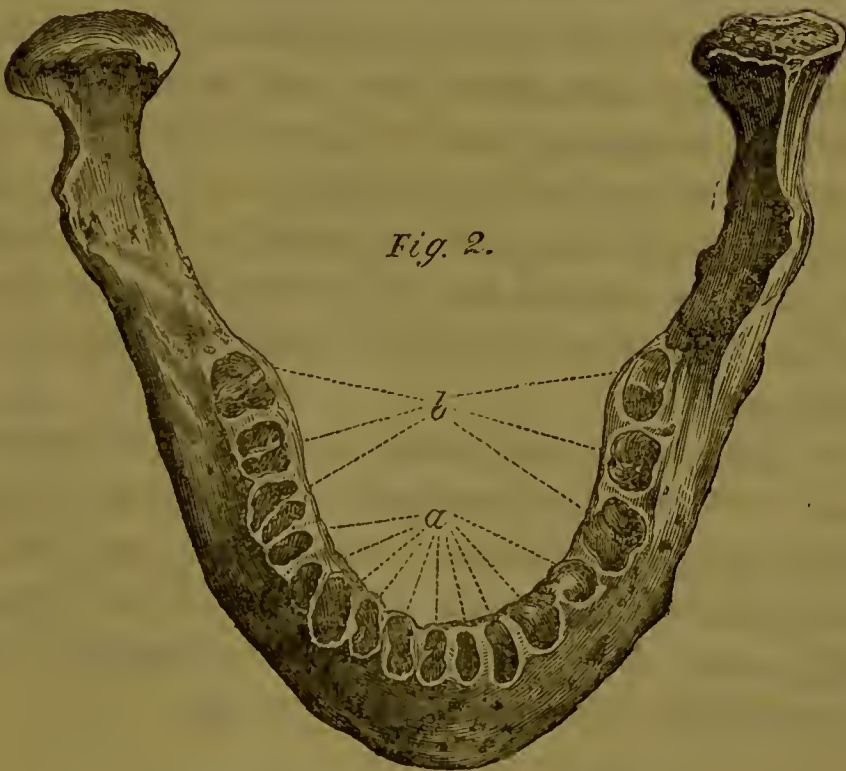


Fig. 2.

- a* The sockets of the ten single-fanged teeth.
b The sockets of the three double-fanged teeth.

“ The teeth rank high among those parts of the animal body, which appear almost as if they were the fruits of distinct miraculous agencies—so difficult is it to suppose a few simple laws of life capable of producing the variety and yet perfect adaptation of parts, which they exhibit. They form an extraordinary set of chisels and wedges for cutting and triturating the food, so arranged as to be most efficient in their operations, and with an exterior enamel, so hard that in early states of society, teeth were used where steel is now. It seems as if the laws of life, astonishing as they are, had still been inadequate to cause teeth, with their hard enamel, to grow as softer bone grows ; and hence has arisen a provision, perhaps more extraordinary still—a set of small teeth appear soon after birth, and serve the child until six or seven years of age ; these then fall out, and are replaced by larger ones, which last for life, and the number is completed only when the man or woman is full grown, by four more teeth which rise to fill up completely the now spacious jaw.*

“ At birth, the teeth have not made their appearance. * * As the organs of digestion in the infant gain strength, and become prepared for an alteration of diet ; the teeth begin to appear, which they do in succession, commencing with the earliest incisors of the upper jaw.

* Arnott's Elements of Physics.

“Teeth being formed of a substance which does not admit of growth in accordance with the gradual enlargement of the jaw, a principle which no where else exists in the body is adopted. Two sets of teeth are furnished, differing in size, number, and some of them in form. The first set consists of four incisors, two canines, and four grinders, or molar teeth in each jaw. During the continuance of the first, the second set are in the progress of development. As they enlarge, they press upon the roots of the first, and deprive them of nourishment, so as to cause absorption of the roots. The former, therefore, are shed without the roots. At birth the bones of the face bear a smaller proportional size to those of the skull than they do subsequently. They rapidly outstrip in growth the bones of the skull, particularly after the seventh year, and continue to increase to the eighteenth or twentieth year. About the seventh year, the second set of teeth, which are larger, begin to supplant the first, and appear in the same order of succession; the two pairs of grinders in each jaw next the canine, have no representatives in the first. They are much longer in making up the number, this not being completed till the eighteenth or twentieth year, when the posterior pair of grinders make their appearance, at a time when the owner, if he has not, ought to have arrived at the years of discretion; hence they are termed the wisdom teeth. Some jaws are so small, however, that

they cannot contain the full number. Some of the teeth therefore remain in the jaw, and, when the others drop out, usually make their appearance, even at a very advanced period of life, flattering the deluded individual, that a renewal of his age is taking place.*"

The typical form of a tooth is a modified cone or combination of cones; in man the base of the cone is in the crown of the tooth, and the apex at the extremity of the root or fang, or on the grinding surface. "In the front teeth we have a simple cone, when seen from the front, the cutting edge corresponding to the base, and the end of the root to the apex of the cone; seen from the side they present two cones united by their bases, the point of union being the neck of the tooth. The crown and root of the canine teeth present each a cone uniting at the neck of the tooth. The molar teeth exhibit in their fangs modified cones, which, uniting laterally at their bases, form the neck of the tooth, while the prominences of the grinding surfaces are formed of smaller cones. Thus, in examining a developing, or a recently-developed tooth, prior to any alteration of form from use, the tendency to the conical formation is every where found."—*Tomes*.

The teeth are developed in pairs, one on either side of the median line; in the perfect adult mouth, they are thirty-two in number, to wit,

* Aitken.

eight incisors, four eye or canine teeth, eight bicuspid, and twelve molars. The temporary, or first set of teeth in the child, amount to twenty in number only; the bicuspid are totally absent, and there are only eight molar teeth, instead of twelve.

A tooth is divided into three parts : the crown, or part which is exposed to view ; the neck, the part which connects the crown with the fang, and is covered with the edge of the gums, and lastly, the fang or root, which is inserted deeply in the socket. The crowns of the teeth are arranged in an even line, no one tooth rising higher than the others.

Hunter describes a tooth as composed of two substances, viz.: enamel and bone. " The enamel," he says " called likewise the vitreous or cortical part, is found only upon the body of the tooth, and is laid all around, on the outside of the bony or internal substance. It is by far the hardest part of our body, insomuch that the hardest and sharpest saw will scarcely make any impression upon it; and we are obliged to use a file in dividing or cutting it. When it is broken it appears fibrous or striated, and all the fibres or striæ are directed from the circumference to the centre of the tooth. This, in some measure, both prevents it from breaking in mastication, as the fibres are disposed in arches, and keeps the tooth from wearing down, as the ends of the fibres are always acting on the food."

The minute anatomy of the teeth has received a great impulse since the time of Hunter, and the application of the microscope to these purposes, has enabled anatomists to make discoveries of a most important character, such as will ultimately effect great changes in the practice of the dentist, and lead to more efficient modes of treatment in some diseases than are at present pursued. Hunter considers teeth to be composed solely of enamel and bone; modern researches have added to these, dentine, ivory or tooth-bone, which forms the great bulk of the tooth. When examined under the microscope, the dentine, or ivory appears to consist of very minute, tapering and branching fibres, imbedded in a dense, homogeneous, interfibrous, or rather inter-tubular substance.

The tubes of which this latter substance is composed, commence in the central pulp cavity, traverse the body of the tooth, in undulating or radiating lines, and make many curves. They are cellular, and according to Tomes' experiments will allow fluids to pass through them, as is seen under the microscope. He says, p. 41, "In the year 1827, I was engaged in examining the structure of teeth, and then came to the conclusion that the dentinal tubes contained an amorphous salt of lime. My opinion was grounded on the following experiment; after preparing a thin section of human tooth, I placed it in the field of the microscope, and then added a little

diluted muriatic acid. No sooner was the acid in contact with the section, than evidence of chemical action was rendered visible by the appearance of bubbles of gas; these emanated not only from the external surfaces of the section, but also from the interior of the tubes, from which bubbles of gas were seen issuing in quick succession. When the action ceased, the tubes no longer presented the appearance of opaque dark lines; but were indistinctly seen filled with transparent fluid." This Mr. Tomes thought was conclusive of the existence of a salt of lime in the dental tubes, but subsequent investigations and the examination of teeth in which the tubes were large, &c., induced him to change his opinion, and regard the evolution of gas as evidence of the facility with which fluids are admitted into their interior, and to consider that the source of the gas existed in the decomposition of the parietes of the tubes rather than of their contents. This important fact, will I have no doubt, be found to have a very marked influence on the causes and progress of caries or decay in teeth. In teeth that are imperfectly formed, and in those belonging to persons of the strumous diathesis, as evidenced by transverse grooves, and other irregularities, with opacity of the enamel, the dentine is occupied by large irregularly shaped and placed cavities, which are sometimes very numerous. In most teeth that have decayed, they are pre-

sent in greater or less number, while in those that decay early in life, they are abundant.

The centre of the dentine is occupied by the pulp cavity, while its surface is coated with enamel, by which the crown of the tooth is covered, and by cement which encloses the body of the fang. The enamel is thickest on the more prominent parts of the crown, and generally terminates in a line on the neck of the tooth. In the temporary teeth, Mr. Saunders describes this terminal line of the enamel as being thicker than that of those that are permanent. This observation applies equally to all the temporary teeth. The cement which coats the fangs is, by some anatomists, considered to extend in a thin layer over the enamel itself; while, by others, it is regarded as terminating on the neck of the tooth, at the part where it meets the enamel.

The enamel, which is the hardest of all the structures which enter into the composition of the teeth, consists of dense, semi-transparent fibres, closely united together side by side. As has been already mentioned, the enamel covers the tooth as far as a certain line on the neck; it serves to protect it from the mechanical or chemical irritation caused by matters that are taken into the mouth. Its fibres form angles on the crown of the tooth, and sometimes, in consequence of their imperfect juncture—especially in the coronal fissures of the molar teeth—the dentine structure

is exposed to external influences, and becomes liable to decay. Where the enamel coats the teeth thickly, its fibres are curved in every direction; on the other hand, on the neck of the tooth, where it is very thin, and near its termination, the fibres are very little curved, and may be readily traced. They, in some instances—principally in old teeth—are intersected by elongated irregular cavities, which are not considered by Tomes as detrimental to the tooth. In this opinion I cannot coincide. The shell of enamel in which they are found must be proportionately weakened; while the fact that such cavities are found chiefly in old teeth, may be held as a proof that they are caused by disease or decay, and, therefore, must necessarily be injurious, and tend to the more rapid loss of the affected tooth.

The enamel-fibres are contained in a membranous sheath, by means of which their respective co-union is effected, and which, with the enamel, becomes subsequently calcified. The union between the fibres may be perfect, or it may be more or less imperfect; in the latter case, the dentine beneath the defective layer of enamel will be exposed to the destructive influences of the secretions of the mouth, and also of the articles that are admitted into it. “The imperfect union” of these fibres “occurs in patches, sometimes small, sometimes large; in one case, following the course of a bundle of fibres, from

the dentine to the surface of the tooth,—in another, stopping short of the surface. The teeth in which this imperfection of development exists in a considerable degree, have the external appearance of being ill-formed. The surface of the enamel is irregular, pitted or grooved transversely, and is generally discoloured. In all such cases the development of the dentine is imperfect, and large cavities are found in its substance.”—*Tomes.*

There are other defects which have been met with in the structure of the enamel, and which may tend to the decay and loss of the tooth,—such as incomplete or imperfect union of the granules constituting the enamel-fibres, and the occurrence of irregularly-shaped cavities in its substance. In most instances the enamel about these cavities is discoloured, and the discolouration extends towards the outer surface. *Tomes* adds that in one instance there was considerable disorganization extending to the surface, which was broken down, thus marking the existence of decay. I have noticed the same thing myself.

The cement, or tooth-bone, as it is sometimes called, although the latter name has been applied and perhaps more appropriately to the dentine, which constitutes by far the greater part of the tooth itself, covers or coats the fangs or roots, and is also said sometimes to afford a thin cover to the crown, thus giving an additional

layer over the enamel itself. This latter, if it does exist, must be regarded as little more than rudimentary. In its structure the cement resembles that of the osseous tissue; it is both cellular and tubular; the net-work thus formed being permeable to fluids. It acts as a coating to protect the dentine in those parts which are not covered by enamel, namely, the fangs, and it not unfrequently unites two or even three of the latter into one mass. This is more frequently observable in the roots of the second and third lower molars, and of the wisdom teeth of the upper jaw. In such cases the amount of cement is doubled—being in fact, the layers of the two fangs united. The cement is very thin on the necks of the teeth, but increases in thickness as it covers the fangs, being thickest at the very apex of the latter.

In the teeth of old persons, or in teeth that have been much worn, the pulp-cavity, which has been already mentioned as situated in the centre of the dentine, becomes greatly diminished in size, or wholly obliterated, by what may be called a secondary development of dentine. The pulp in such cases is changed into dentine, the new uniting or not with the previously-formed tissue. Such dentine is usually traversed by vascular canals, around each of which the characteristic branching tubes are arranged in radii, as those of the body of the tooth are arranged around the pulp-cavity.

The parts of which we have been speaking are supplied with blood-vessels and nerves—more especially the dentine and the cement. The blood is conveyed to them and to the gums by branches from the external carotid artery, each tooth having a separate branchlet;—the nerves are derived from the fifth pair. Branches from the fifth pair of nerves supply the face, and are freely connected with those belonging to the teeth; thus affording a ready physiological explanation of the extension of pain to the face and temple in severe tooth-ache, and also of the participation of the teeth in rheumatic affections of the face. The sympathetic pain experienced in sound teeth, under similar circumstances, is also explicable by the connection of the nerves supplying those parts. The severity of the pain in tooth-ache is occasioned partly by the sensitiveness of the nerve itself, and partly by the inflammation occurring in a bony cell, which does not admit of the occurrence of swelling, by which inflammatory pain is generally relieved. The blood-vessels and nerves, in the full-grown tooth, are exceedingly minute. They enter by a small hole in the root, the passage becoming enlarged inwards, so as to form a small cavity, the pulp-cavity,—where the process of nutrition goes on.

The teeth are organs of touch of exquisite sensibility. Their sensitiveness is such that we are enabled at once to detect the character and nature of any extraneous body conveyed into the

mouth, by the impression made on them by contact with it. This, and other characters belonging to the teeth, have been so well described by Dr. Graves, in his work on Clinical Medicine, that we shall not make any apology for transferring the passage entire to our pages.

“ The teeth are immoveably fixed in the jaws, and consequently require no nerves of motion so far as they themselves are concerned; they are, on the other hand, abundantly supplied with nerves derived from the fifth pair—a nerve of sensation—and their nervous apparatus is developed and expanded within their substance in a manner which shews that nature has bestowed a greater degree of care on this than on any portion of the nerves destined to perform the office of touch. In this respect they, to a certain extent, approach the perfection of the nervous apparatus of the organs of sense, properly so called. In truth, no part of the mechanism of the human body seems more admirable than that which thus associates together in function a soft nervous pulp and a solid osseous substance; and associated together they assuredly are, for the teeth, though encrusted with a coat of enamel as hard as steel, are very delicate organs of touch; the most minute bodies, when hard, may be distinctly felt, if placed between their edges; and matter of more yielding texture, as a leaf of paper, or a rose-leaf, can be distinguished in the same position. The delicacy of touch enjoyed

by the teeth has not attracted due notice, nor have its uses been sufficiently dwelt on; for to this sense are owing the ease and precision with which, as instruments, they perform their proper office of cutting, tearing, and grinding the food. It is from the feelings imparted to their edges that we derive instant knowledge of the situation, and many of the physical properties, of the morsel—such as, its hardness, consistence, shape, size, &c.—in consequence of which, it is either at once submitted to the action of the teeth, or is removed, to be placed in another part of the mouth, and in a more convenient position, where teeth of a different shape and form may be brought to bear upon it. Without this exquisite sense of feeling, one row of teeth could not act in concert with the other—the incisors and molars, in the under jaw, could not adapt their cutting and grinding surfaces to those in the upper jaw, for the purpose of commanding the consecutive motions they are called on to perform. In fact, the teeth are not merely cutting instruments, but are endowed, as it were, with intelligence; they are, it is true, assisted in ascertaining the size, position, hardness, and other physical qualities of the morsel, by the tongue and cheeks; but they perform, besides, a peculiar function—that of feeling the intimate texture of what is submitted to their immediate operation, thereby warning us instantaneously when the morsel contains anything detrimental to their own substance. Without

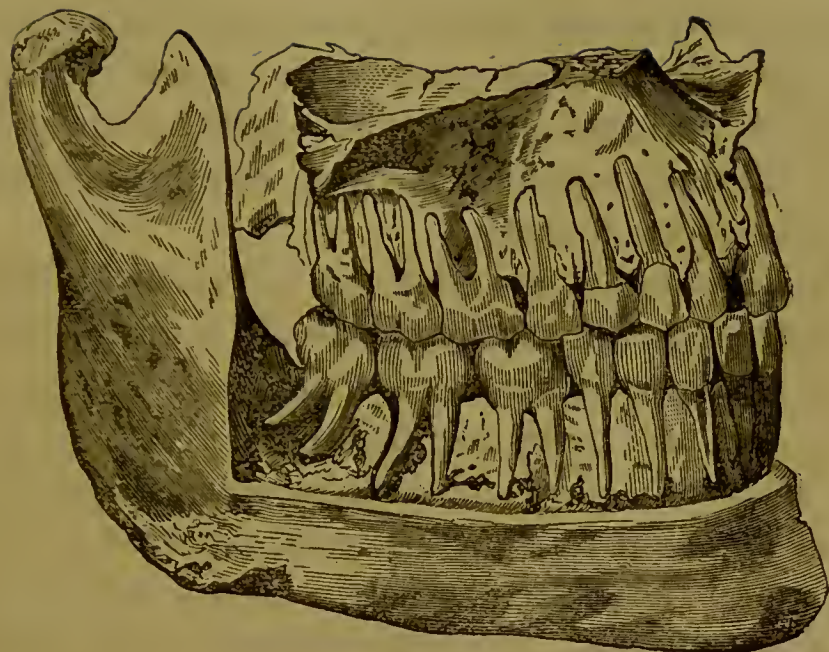
this sense of touch, how soon would our teeth be chipped away, and worn by minute but hard matters, as grains of sand, which no care can entirely exclude from our food, but which the teeth detect at once when in contact with their edges, and which they at once refuse to act on. In truth, the teeth may, in this point of view, be considered as a sort of fingers fixed within the mouth, destined to feel, examine, and adjust the morsel, preparatory to placing it in the position most favourable to its mastication."

The alveolar processes, or teeth-sockets having been already described, we may next advert to the position of the teeth in their sockets. The kind of articulation by which they are retained there is called by anatomists *gomphosis*; they are retained in their position by the close adaptation of the alveoli to the fang, by the strong adhesion of the membrane which lines the sockets and is reflected over the roots of the teeth, and by the divergence or crooked shape of the fangs belonging to some of the teeth, which, meeting with a corresponding divergence in the shape of the sockets and its several partitions, not only aids greatly in the retention of the tooth *in situ*, but offers great opposition and obstacle to its extraction, when any cause renders that operation advisable.

The gums afford also considerable support to the teeth. They not only serve as firm elastic cushions, whereby they rapidly diffuse the force,

and powerfully support the teeth when forcibly employed, but, by the vascular connection between them, in part supply them with nourishment. In old age, when the different parts of the body begin to shrink, the gums recede from the teeth; so that, although they are perfectly sound, they frequently become loose, and drop out. By the manner in which the teeth are implanted in the sockets, they have an extensive surface of support. The force is not concentrated at the point, as in the case of a nail driven into a board, but is uniformly diffused over the whole surface of the fang; as, for instance, the fangs of a middle tooth press on a surface equal to four times the extent of that of its crown; so that, supposing the pressure on the crown to be equal to four pounds, being extended over the surface of the fangs, it is reduced to one pound at any given point of the root—and, consequently, to a similar amount of force on the sockets.

The woodcut represents a side view of the upper and lower jaws, from which the outer plates of the alveolar process have been taken off, to expose the fangs of the teeth in their sockets. The length of each fang is at once seen with respect to that of its neighbour.



We come now to the consideration of the characters of the individual teeth. The perfect adult mouth contains thirty-two teeth; namely, eight incisors, four canines, eight bicuspid, and twelve molars. The temporary teeth are twenty in number only, and consist of eight incisors, four canines, and eight molars.

The incisor teeth (we are speaking of the adult or permanent teeth) are four in number in each jaw. The anterior or outer surface, or that which is immediately exposed to view on opening the mouth, is very slightly convex, the inner surface rather concave; the tooth is wedge-shaped from behind forwards, and terminates in a broad cutting edge. The root is conical, and, in fact, the tooth itself presents the figure of a tolerably per-

fect cone. The central incisors of the upper jaw are larger than the lateral incisors—the reverse of this rule holding good with respect to the teeth in the lower jaw. The central incisors of the inferior maxilla have a compressed and slightly-grooved root.

The canine or *cuspidati* are situated between the lateral incisor teeth and the bicuspid. They are the largest of the teeth which have but single fangs, and are more deeply implanted in the jaw. The shape of the crown is peculiar; its greatest diameter is about midway between the neck of the tooth and the obtuse point in which the crown itself terminates. The tooth is convex externally, and slightly ridged; there is a ridge also on the posterior aspect of the tooth, the sides of the ridge being inclined planes, that next the bicuspid being the more convex. The fang of the canine tooth is long and grooved, as if an attempt had been made by nature to divide it into two roots. The crowns of the canines of the lower jaw terminate in a broad point, and the body of the tooth is less convex anteriorly than that of the tooth in the upper jaw; the fang is rather shorter, and more deeply grooved laterally.

The bicuspid, which come next, are four in each jaw, two on either side. They constitute the most simple form of molar teeth, and are called sometimes the premolars. They are also occasionally distinguished as the first and second

bicuspid. The crown consists of two cones united laterally, each possessing, or terminating in its own fang. The anterior surface of the tooth is convex, and so is the internal, which is placed vertically to its alveolus. The external tubercle of the crown is the larger, and the crowns themselves are at least one-third shorter than those of the teeth already mentioned. The fangs are generally two in number, corresponding to the tubercles or cones composing the crowns; if there should be only one, it is very deeply grooved, and in some instances divides into three points at the apex, thus shewing a strong tendency to the formation of three fangs similar in position to those of the molar teeth of the upper jaw. The bicuspids in the lower jaw are more convex anteriorly than those in the upper, and the tubercles or cones of the crown are less marked, the dividing grooves being more or less imperfect. The fang is seldom, if ever, double. Tomes says these teeth may be regarded as intermediate between the canine and the bicuspid of the upper jaw.

There are three pairs of molar teeth in each jaw; the first and second of which, being much alike, may be described together; we will take those of the upper jaw first.

The upper surface of the crown, by which the process of trituration during mastication is effected, consists of four tubercles or cusps, separated from each other by ridges, and strongly

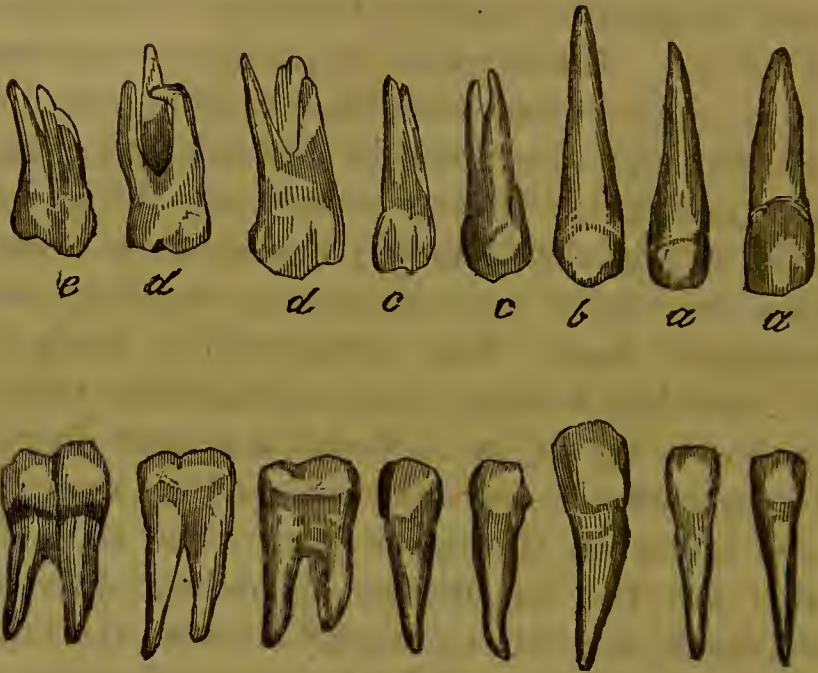
protected by enamel, except in the depths of the grooves, where it is not unfrequently imperfect, and thus gives rise to decay, this latter process being partly aided by the lodgment of particles of food. The tubercles forming the crown may sometimes vary in number, several smaller taking the place of one or more, or again two of them being blended into one. The body of the tooth is convex anteriorly and posteriorly; the sides of which its figure is composed, are united by two obtuse and two acute rounded angles. The roots or fangs are three in number, two external and one internal. The anterior external is larger than its fellow, and stands a little more outwards; the internal or palatine fang is the largest of the three; it is broad and thick at its base, and if there be two inner coronal cusps or tubercles, it is grooved as though formed of two conical roots; its direction is obliquely upwards and inwards towards the palate. In these, as in the preceding teeth, the number of the fangs may vary; they may be four in number, or only two, in consequence of the union of the palatine with one of the other fangs. Bell has occasionally found these teeth possessing five fangs.

The first molar in the under-jaw is the largest; there are five tubercles on the crown, the fifth, a wedge-shaped one, being situate between the two anterior and the two posterior. The fangs are two in number, very strong, much compressed, and grooved behind and in front. They are generally

divergent, and turned a little backwards. The second molar does not in general possess the fifth tubercle on the crown, nor is it so large as the first.

The third molar in the upper jaw is generally more irregular in shape, and smaller in size, than its fellows. The fangs are frequently compressed into a conical mass, sometimes turning in one direction, and sometimes in another, but generally backwards. It has occasionally three distinct, well-developed fangs; but they are sometimes met with more numerous, smaller, and irregularly bent. The corresponding tooth in the lower jaw is larger, has generally four tubercles on the crown, and presents a greater degree of resemblance to the other molars, than does the third molar in the upper jaw. The roots or fangs are two in number, generally directed backwards, and very commonly connate, the lines of union being marked by longitudinal grooves; a similar groove is also seen on the other sides of the root; thus giving evidence of the tendency to the development of four fangs, corresponding with the four cusps or tubercles of the crown. The third molar tooth is that called the *dens sapientiæ*. These teeth have a much less firm hold in the jaw than the other molars.

Views of the Teeth of one side of both Jaws, taken out of their Sockets, to show the whole of each Tooth.



Row 1.—The teeth of the upper jaw, seen from the outside.

Row 2.—The same view of the teeth of the lower jaw: the five single are similar to those of the upper jaw, but the molar teeth in this have only two fangs.

Row 1.—*a a* The two incisors.

b The canine, showing how much it is longer than the others.

c c The bicuspidati.

d d The two first molars, having three fangs.

e The third molar, or *dens sapientiæ*, also having three fangs.



Rows 3 and 4.—A side view of the same teeth, showing that the incisors and canine in this view differ from the former, more than the bicuspid or the molars.

Row 3.—*a a* The two incisors of the upper jaw, showing the hollowed inner surface of the body of those teeth.

b The canine, showing the same.

c c The bicuspidati, showing the two points of the basis of each, the first having a forked fang.

d d The first and second molar teeth.

e The third molar, or *dens sapientiae*.

The milk teeth are altogether smaller than their successors. The canines of the first set in the upper jaw are like their permanent successors, except in size. Those of the under jaw are more curved than the permanent teeth. There are not any bicuspid belonging to the first set, and their place is occupied by the deciduous molars, which resemble the permanent molar teeth rather than the bicuspid; from which latter they differ in the number of their fangs, and, in some degree, in the formation of the crown. The temporary molars resemble their permanent successors; the first temporary tooth bearing a likeness to the second permanent, and the second temporary to the first permanent. The fangs of the temporary molar teeth are, however, more divergent than those of the permanent set.

“ In taking a retrospective view of the anatomy and physiology of the teeth, we are forcibly struck with the adaptation of these organs to their peculiar functions. Early in life, when the jaws are small and comparatively powerless, the small and more delicate milk teeth are provided by nature to perform the necessary office of mastication. When the body has increased in size, and the jaws have become larger and more powerful, the smaller teeth are, by a natural process, removed, and a stronger and more numerous set is developed, with which we are enabled to masticate the 'more solid food required for the sustenance of the adult.

“ Like the bones generally, the teeth are required to support mechanical resistance, and in them, too, we find the structure admirably adapted to this end; but in the teeth the mechanical force is direct in its application; and in them we find a peculiar arrangement of osseous structure, enabling them to withstand without injury the force so applied. And as a further adaptation, the teeth are endowed with a lower degree of organization than the bones, and are thence less susceptible of injury; while the latter, clothed with soft tissues, and capped with cartilage, are thus defended from the more immediate effects of mechanical force.

The teeth are said to possess in themselves no power of reproduction by which an injury can be repaired. This is not strictly true. The injury to which, in a state of nature and health, they are most liable, is wearing away of the masticating surface from use. The worn surface certainly is not renewed, but the teeth increase in density, and the pulp-cavity diminishes in size by the formation of dentine, so that the actual amount of dentine is not diminished, while the density is increased. In each of these actions we recognise a form of renewal, which in some degree compensates for the loss by abrasion. If the whole act of mastication is from any cause thrown upon two or three teeth, then these naturally, by the excessive use, wear away, till at last the whole crown is exhausted.”—*Tomes*.

In a work like this, intended simply to draw attention to the anatomy and physiology of the teeth, with a view to their more ready and effectual extraction when decayed, it would be a task of supererogation to dilate more on the present subject. Enough has been said to recal to the mind of the practitioner the anatomy of these organs, should he have forgotten any portion of his former studies, and to enable him to appreciate the improvement in dental surgery which it is the object of this work to describe and illustrate.

Those who are anxious to study the formation of the teeth, and their irruption, a description of which would be foreign to this work, will find themselves amply rewarded for the time and labour bestowed on the perusal of Mr. Tomes' work. It is one of the most valuable and most elaborate of all the productions on dental anatomy and physiology. The works of the celebrated John Hunter, Professor Owen, Bell, Fox, Nasmyth, and some others may also be consulted with advantage.

The causes which render extraction of the milk or temporary teeth necessary, are caries or necrosis, a too crowded state of the jaw, and the persistance of the tooth, when its permanent successor is making its way through the jaw.

The causes of caries have been differently described by authors: inflammation of the pulp-cavity is assigned by Fox and others, of the

dentine by Bell, and chemical decomposition of the tooth, by Robertson, as the cause productive of this disease. Tomes defines caries to be “the death and subsequent progressive decomposition of a part, or of the whole, of a tooth;” and adds that there must be “a concurrence of dead dental tissue, and of a condition of the oral fluids capable of decomposing the dead part before the phenomena of caries can be developed.” The predisposing causes may be constitutional or local.

In the anatomical description of the structures of the teeth, several original defects relative to the enamel and the dentine were mentioned, as leading to the occurrence of caries, as predisposing causes. They consist in defects of quantity and quality, and the presence of cells or cavities in the enamel and dentine fibres; and are attributable to the patient having suffered from ill-health at the time the dental development was in progress.

Among the causes of caries, Chelius mentions the improper use of acrid or acid substances, negligent cleansing of the mouth, alternate use of cold and hot food, tobacco-chewing, and mechanical injury of the teeth, by which the enamel is destroyed, and its internal substance exposed to the air.—*System of Surgery, by South.*

The disease may commence in the crown of the tooth, in the fissures where the enamel is more or less imperfect, or in its body. It commences by discoloration of the tissues, which is

succeeded by softening, and finally by disintegration. The enamel first suffers; but when an opening is made through it to the dentine, the destructive action spreads rapidly in a lateral and inward direction towards the pulp-cavity, and speedily undermines the enamel. The outer surface of the latter may continue apparently sound, when undermined and suffering decomposition from within. The cavity thus formed in the crown of the tooth presents a conical appearance; if the dentine of the neck be the seat of the disease, it will probably be wedge-shaped. If unattended to, the caries will continue to make progress until the whole tooth is destroyed. The pain which attends the commencement of caries is of a dull aching character, but sometimes the tooth is only rather tender, and occasionally the abnormal sensations are so slight as not to attract notice. There may be, however, greatly-increased sensibility of the organ from the beginning. The severity of the pain becomes much greater, and is often described as excruciating, when the pulp-cavity is exposed.

“ The consequences of caries are various. The disease may commence and progressively destroy the crown of the tooth, and very little pain may be felt during the process—or it may be arrested after the destruction of the crown, and the roots of the tooth may remain in the gums, and give little or no inconvenience. But, on the other hand, pain may commence with the disease—the

pulp, as the disease advances, may become inflamed, and, if the tooth be not removed, the inflammation will extend to the dental periosteum, and be followed by alveolar abscess—the pain all the while increasing. Not only may alveolar abscess arise as a consequence of caries, but periostitis, and subsequent necrosis of a large portion of the jaws. Tumors of the gums may arise as a consequence of caries; as, also, many fungous growths of the pulp.”—*Tomes*.

Mr. Descot mentions an instance in which a very severe neuralgia of ten years standing, was removed by the abstraction of a carious tooth; similar instances of disease, of longer or shorter duration, proceeding from the same cause, have been recorded by other writers.

Without entering into the treatment of caries, which would be here out of place, we may observe, that when it is recent and of small extent, the skilful dentist will be able to arrest its progress, and render the diseased tooth useful for years. If the disease have been of long standing and a large portion of the tooth be involved, the operation of extraction has become necessary; it is most essential, therefore, that a frequent examination of the teeth by a dentist be made, to watch the occurrence of caries, and arrest its insidious progress.

The remarks on caries apply to the permanent, as well as to the temporary teeth.

Necrosis is by some writers regarded as a dis-

inct disease from caries, although generally dependant on, and caused by it. The term is used to imply the death of the whole tooth, and the disease is more frequently met with in the temporary teeth. It follows caries of the crown and the exposure and death of the pulp, by which the life of the fangs is destroyed, the alveolar process becoming absorbed, ulceration following, and the fangs exposed, and detached. Extraction of the dead tooth is absolutely necessary.

Inflammation of the periosteum lining the socket, followed by suppuration, will require the extraction of the tooth, and probably the adoption of ulterior measures, based on the state of the parts, to effect a cure.

On the crowded state of the jaw and the persistence of a temporary tooth, when its successor is seeking to make its way, or is driven to force a passage at a part, where nature never intended it to appear; but little need be said. Cases have occurred of the continuance of some of the temporary teeth, generally the milk molars, till long after puberty. The fangs of the first set in these cases are not absorbed. It must be self-evident that, under such circumstances, extraction is the only remedy.

The causes leading to the extraction of the permanent teeth are, caries, necrosis, exostosis of the fang, alone or as a sequence of caries, perioritis of the fang, simple or complicated, loose and

painful teeth, mechanical injury of the teeth, and neuralgia and tic-douleureux, dependent on a diseased condition of the teeth.

Caries and necrosis differ but little, if at all, when they affect the permanent teeth, from those diseases in the temporary set. It is therefore needless to recapitulate the remarks already made. Exostosis of the fang and periostitis generally arise from the pre-existence of caries, and the irritation it causes. They may, however, occur without any such previously-existing disease. Exostosis is very likely to follow the operation of pivoting. Epilepsy, tic-douleureux, neuralgia, and vague wandering pains about the head and face, and other anomalous symptoms, are caused sometimes by caries or exostosis, and are curable only by the removal of the offending tooth. The mouth should be carefully examined in all such cases.

Fracture of the teeth, involving exposure and destruction of the pulp, may be caused by a sudden and violent closure of the mouth, or by a blow and fall. The injured tooth may sometimes be saved, but it frequently requires to be removed, both on account of the severity of the pain, and also to prevent more serious mischief. When a tooth has been knocked out altogether, it may be replaced; but even when that has been done immediately, it may die, become a source of irritation, and its subsequent removal be rendered necessary.

Looseness of the teeth is one of the causes which lead to their extraction, the tooth or teeth being perfectly sound, and the disease itself being seated in the gums or sockets. One of the most common causes of this is, inflammation of the parts just named. Dr. Graves (Clinical Medicine) says:—" Sometimes this originates in disease of the tooth itself, or of the gums; but, in other instances, the diseased process commences in the alveolar periosteum, and by spreading to the socket and gums, it gives rise to great pain, swelling, and sponginess of the latter; while it eventually detaches the fangs of the teeth implicated in the attack from the grasp of the sockets, and thus at last the teeth fall out, though in themselves they exhibit no appearance of decay.

" The progress of the disease is accompanied by extreme pain, and, as a puriform discharge oozes out between the gums and the inflamed periosteum, many limit their attempts to local means, and often succeed in effecting a cure by frequent applications of leeches to the inflamed gum; and, in very obstinate cases, by incisions freely made through the gums and inflamed periosteum. Last year, a patient of mine was thus affected, and thus treated—and although under the care of a most skilful surgeon, and of an eminent dentist, he lost successively a left bicuspid and molar of the upper jaw. His sufferings were for a short time relieved by the extraction of each tooth, but in a few days became

as agonizing as ever; he found all the neighbouring teeth loose, and was told that they also must soon be drawn. Happening to mention his case to me, I immediately recollected that, a year before, I had successfully treated him for a periostitic affection of the sternum and ribs, and that hydriodate of potash was the medicine which served him the most. I recommended him to use ten grains of it three times a day, and had the satisfaction of perceiving a daily improvement, so that the pain and inflammation soon ceased, and in about ten days the teeth were all fastened.

“The periostitis to which this gentleman was liable was of a rheumatic nature; his constitution was otherwise sound, and he was only thirty-four years old.”

A similar condition of the gums and alveolar periosteum may be the result of the long-continued administration of mercurial preparations, in small or moderate doses. The disease in that case pursues a more chronic course, and may continue for months, and even years. It has in several cases within my knowledge eventuated in the loss of almost all the teeth in both jaws—the teeth themselves being generally perfectly sound, but so loosened in their sockets, and the latter so diseased, that the slightest touch or pull would at once remove the tooth.

When pain is experienced in the jaw, face, or ear, and referred to the teeth, but is so indefinite

that its exact seat cannot be stated, it will be advisable to remove any stumps there may be in the mouth, as it may be caused by thickening and disease of the periosteum.

The following remarks, forming the commencement to Bell's chapter "on the extraction of teeth," are so completely in accordance with our views, that we transfer them at once to our pages, feeling convinced that his name must add weight and influence to the observations, which at the same time are such as must accord with the experience of every practitioner.

"The operation of extracting the teeth, though not unfrequently consigned to persons who have no pretensions to professional knowledge, and in many instances even to the lowest mechanics, is one which nevertheless requires for its judicious and safe performance, as much care and firmness, and as correct an acquaintance with the anatomy of the parts concerned in it, as many of the operations of surgery, to which a much higher degree of importance is commonly attached. That in the greater number of instances, this operation is performed by mere mechanical force, without any very serious consequences occurring, may be granted; but it is no less true, that even in the most simple cases, the pain of the operation is greatly diminished by a judicious choice and application of the instruments; whilst the frightful

results which sometimes accrue from the employment of ill-directed violence, forcibly point out the necessity of some degree of surgical skill to render it at once safe and successful. Every country village has its stories of the loss of portions of the jaw-bone—the extraction of sound teeth in mistake for the decayed ones—and various diseases which are attributed, with greater or less truth, to this cause, and for which the barber or the blacksmith has to atone.”

It is not alone these uneducated pretenders to surgical dentistry who are generally at fault in extracting teeth. Druggists, and even surgeons and professed dentists, from the faulty construction and application of their instruments, from the want of an external lever, and from the misapplication of the extracting force, may not unfrequently fracture the tooth, lacerate the gum, or splinter the jaw-bone during the operation, as the following pages will amply shew.

In the extraction of teeth, several kinds of instruments are used; the forceps and the key being those principally employed. The pelican is also sometimes used, while the punch or elevator is put in requisition for the removal of stumps. All these instruments have their disadvantages, principally from their faulty construction as regards their *point-d'appui*. Of all these, the key is the one the use of which causes the greatest amount of pain, and is the most likely to inflict injury on the tooth and surrounding parts.

Chelius (*System of Surgery*) says:—"In general, the drawing of a tooth with the forceps is the least painful; it is, however, only applicable to the front, or to loose back teeth. The key is best for drawing the hind teeth, as it permits the use of greater force, without injury to the other teeth, and has not any rest upon the neighbouring teeth; the gums are, however, frequently crushed, and the tooth not rarely broken. The pelican acts more safely; it is applicable to all the hind teeth and their stumps; the gums are not crushed, and the tooth not easily broken; but the neighbouring teeth must afford it support, and are liable to be thereby depressed; the tooth can also be drawn with it only outwards."—*System of Surgery, by South.*

There are several errors in this statement, which we have not space to point out; it serves, however, to shew some of the disadvantages of the instruments in question. The key admits of greater (unnecessary) force, so that *the gums are not unfrequently crushed, and the tooth not rarely broken*—to which we may add, splintering of the jaw, with exfoliation and necrosis, vicinal inflammation, and extensive abscesses. A pretty catalogue, truly, of disadvantages. The pelican—the safer instrument—may depress the neighbouring teeth, which it cannot do without causing alveolar inflammation, and, perhaps, periostitis; thus laying the foundation for their subsequent loss and ultimate extraction. While such opera-

tions are performed, false teeth must be at a premium.

The evil consequences attendant on the operation are thus enumerated by Chelius; they are described somewhat quaintly as “awkward circumstances.” “Breaking off the crown of the tooth, breaking the alveolar process, bruising, tearing, or completely stripping-off the gums, loosening the neighbouring sound teeth, partial dislocation of the teeth, fracture of the jaw, slipping of the claw from a diseased to a sound tooth and its extraction, severe bleeding, inflammation and suppuration of the gums, and caries of the alveolar processes.” The majority of these accidents occur with the key instrument; some are dependant on the construction of the instrument, and others on the bungling manner in which it is used. It ought to be banished from practice altogether.

Robinson, however, holds a different opinion. He considers that the employment of the forceps should be limited, and that the key is indispensable in certain cases. His directions for using it are as follows:—“The application of the fulcrum must depend somewhat on the state and position of the carious portion of the tooth; but the claw should be so placed as to come on the *neck* of the organ, close to the edge of the alveolus, and parallel with the upper part of the fulcrum, the bite of the claw and this part of the fulcrum being in the same horizontal plane.

“The operator, having properly adjusted the instrument, according to the above directions, next, by gently and firmly turning the wrist (care being taken, in the meantime, that the claw or fulcrum does not slip), causes the upper part of the tooth to act as a powerful lever for moving the lower part, and for dilating the corresponding portion of the socket, which, by its lateral enlargement, makes room for the tooth as it is raised by force out of its situation in the mouth.”

If this passage be fairly translated, instead of reading “*dilating the corresponding portion of the socket, which by its lateral enlargement,*” we should say, “*fracturing the wall of the socket, which by its giving way*”—as it is utterly impossible for bone to dilate even under the amount of force applied during the use of the key instrument.

The engraving which is annexed is copied from one in Mr. Robinson’s work, and serves to shew one of the evil results of the operation. It is perfectly true, as Mr. Robinson says, that mischief may follow the use of any surgical instrument; but when, as with this instrument, the disadvantages counterbalance its advantages, its use should be abandoned.



The annexed woodcut represents the possibility of fracturing the tooth by an improper application of the key, or from using too large a claw. The tooth is liable to be broken in the direction of the dotted line. The drawing is taken from Fox's work "On the Human Teeth."



Bell recommends the key for the bicuspid of the lower jaw, and the forceps for the first and second molars, excepting when the tooth is much decayed on one side. The *dentes sapientiæ* of the upper jaw, he says, should never be extracted with the key, as from the soft texture of the tuberosity of the jaw, it is liable to fracture, and exfoliation has repeatedly followed the use of that instrument. He recommends the forceps, or if the tooth be much decayed, the elevator. He also advises the latter instrument for the same teeth in the lower jaw, although the others may be employed. Tomes recommends the forceps generally for all the teeth.

Dr. Arnott, in his valuable work on the "Elements of Physics," speaking of the tooth-key,

says—" It is an instrument found in the hands of almost everybody who pretends to even the lowest degree of skill in the healing art, and there is perhaps scarcely a day passing in which teeth are not broken, and jaws splintered, and gums bruised even to sloughing, by the unskilful or even awkward use of it. The common tooth-key may be regarded in the light of a wheel and axle, with the hand acting on two spokes of the wheel to move it, while the tooth is fixed to the axle by the claw, and is drawn out as the claw turns.

"The gum and alveolar process of the jaw form the support on which the axle rolls. The common errors of the operation of tooth-drawing by the key are these:—

" 1st. Turning it towards that side, where the adjoining teeth are too close for the moved tooth to pass, without either being broken itself, or breaking one of them. Sometimes two teeth are thus drawn, instead of one.

" 2nd. Neglecting the natural inclination of the tooth. By winding it round in the direction in which it already inclines, and in accordance with a bend which is generally found in the tooth itself, the operation is easy and safe; while, if drawn in the opposite way, it not unfrequently breaks or splinters that part of the jaw-bone in which it sticks.

" 3rd. If the tooth-claw be blunt, and its point slip high upon the tooth, it then acts almost

directly across, and is very apt to break the tooth.

“ 4th. And unless the axle or fulcrum of the key be made to rest as evenly as possible on the gum, it will tear or very much injure the gum. It should bear or rest, if possible, over the part of the bone in which the tooth is set; for otherwise, as when a back-tooth is drawn, with the instrument resting upon a part considerably anterior to it, the twist produced is painful, and there is danger of splintering.”

There is a great variety of forceps in use by dentists, very many employing instruments slightly modified in shape or in action from those in ordinary use, but all having their fulcrum upon the adjoining teeth, and requiring extensive lateral action to effect the removal of the offending tooth. They require great strength of wrist, and much practice, to be used successfully, but, in skilful hands, are far preferable to the key. They are not without their disadvantages, for the tooth may be crushed, or the crown broken off, if they are employed with violence. The principal evil, however, is there not being any external fulcrum, so that it is necessary in order to extract a tooth, to use so much lateral force in loosening it and detaching it from its adhesions in the jaw-bone, as more or less to fracture the alveolar process, while the *point-d'appui* being the adjoining teeth, they are necessarily depressed and subjected to injury. In fact, it is almost impossible

to extract a tooth with the forceps, without the aid of the external fulcrum, so as to take off the pressure from the adjoining teeth during the operation, without incurring a certain amount of risk.

The subjoined engraving represents several teeth which have been broken off by the forceps, with a portion of the jaw in which they were imbedded.



Robinson says the use of the forceps "is limited, as their employment should be, to cases in which decay has only exposed the lining membrane of the tooth, leaving sufficient substance of bone to withstand the pressure. On the contrary, where the crown is much decayed, the mere effort to detach the tooth, and the pressure necessary to prevent the instrument from slipping, will be greater than the remaining substance can bear without breaking. For this reason," he adds, "we have our misgivings when we hear it said that the forceps alone is made use of in every case. Surely, either extraction must be performed when the tooth might be saved by stopping, or the operators must be very fortunate in their patients, or else they must each

have large cabinets of broken teeth." These remarks are applicable only, be it remembered, to the ordinary mode of using the forceps. The inconveniences alluded to do not occur when the external fulcrum is employed.

The following case, which has been recently published in the *Lancet*, shews clearly some of the dangers resulting from the present mode of extracting teeth:—

“ CASE OF EXTENSIVE NECROSIS OF THE LOWER
JAW—OPERATION—RECOVERY.

“ Timothy P——, labourer, aged twenty-four, a man of irregular habits, was admitted into the Royal Free Hospital, under the care of Mr. T. Wakley, June 1st, 1848, suffering from necrosis of the lower jaw on the right side. The history which he gives of the disease is, that, last July, he suffered severely from toothache; and after some days he went to a dentist (*query*, to a druggist?) who extracted the painful tooth, one of the lower molars, but with considerable violence. About a fortnight after, while eating his dinner, he felt something crack near the place where the tooth had been extracted. The opening left by the extracted tooth never healed. Soon after the period of feeling the crack, a discharge came on, at times in considerable quantity, and very fœtid. He applied to Mr. Whidbourne, surgeon, of Gower-street, who,

considering the jaw-bone diseased, advised him to apply to Mr. T. Wakley, at this hospital.

“ *Present appearances.*—June 1st. There is a rounded, oblong, bony tumor on the right side, extending along the horizontal ramus of the lower jaw, from its angle to within an inch of the symphysis; it projects outwards, and there is a good deal of irregular swelling and thickening of the soft parts in connexion with the vertical ramus. The bony growth is limited to the external surface of the jaw, the internal being free from deposit, or other alteration from its healthy character. There are several openings within the mouth communicating with the diseased structure, and a probe passed into any one of them strikes against compact, bare bone; a portion of bone, also—seemingly a large piece—can be felt loose, surrounded by new bone. An operation was proposed to the patient, to remove the necrosed portion, to which he at once consented. Having been duly prepared, Mr. T. Wakley proceeded to perform the operation, on June 12th, assisted by Mr. Gay and Mr. Erasmus Wilson.

“ The patient being first put under the influence of chloroform by Mr. Robinson, Mr. T. Wakley commenced the operation by making a free incision through the integuments, with a large bistoury, from a little above the angle of the jaw, and carrying it forwards along the lower border of the horizontal ramus to within an inch of the symphysis; the upper portion was then quickly

dissected up as a flap, by detaching it with a few touches of the knife from its connection with the bone. In the course of this dissection the facial artery was cut across; this was immediately tied, as were also two other smaller vessels. The condensed tissues on the surface of the bony tumour being cleared away, the shell of the new bone forming the projecting tumour was readily exposed to view, and an opening being made into it with the cutting forceps, the necrosed portion of bone, about two inches in length, was removed by a pair of strong dentists' forceps. The finger passed into the cavity left by its extraction, could not detect any other diseased portion; the wound was, therefore, carefully sponged, and all bleeding having ceased, it was accurately closed by eight points of suture, and lint, dipped in cold water, applied. To take at bed time, the following draught:—tincture of opium, half a drachm, camphor mixture, one ounce.

“ June 13th. Has passed a very good night; no bleeding.

“ The ligatures from the vessels came away on the 21st June, the wound being nearly healed throughout, and the man not having had a bad symptom since the operation. Discharged cured, June 25th.

“ August 1. The swelling and disfigurement on the side of the face are rapidly subsiding, and the patient is perfectly free from the disgusting fœtor and discharge, which made him have

recourse to the operation. There is slight paralysis of the muscles of expression, from the division of some branches of the facial nerve, but to a slight extent only."

It is rather singular that the *Lancet*, the medical journal from which the preceding case has been extracted, should contain, in the following number, the details of a case of exostosis of the lower jaw, also caused by the extraction of a tooth. The patient was a Spaniard, a native of Villa Buona in Biscay, and was admitted an in-patient of St. George's Hospital, May 1st, 1848, under Mr. Tatum, with a tumour of the lower jaw of considerable size. The tooth, the extraction of which had caused the appearance of the diseased growth, had been removed about five years previously; the disease commenced soon afterwards, and made a gradual progress for three years, when it was partly removed in France. It increased in size more rapidly after that, and when the man was admitted into St. George's, it was nearly as large as the doubled fist, was uniformly hard and irregular on the surface, and apparently involved the whole of the right side of the lower jaw; internally it projected so much as materially to diminish the cavity of the mouth, and the posterior fauces.

The operation which was performed a few days afterwards for the removal of this very serious disease, consisted in the amputation of that part of the lower jaw, which was involved in the

disease. The patient having been brought under the influence of chloroform, an incision was made, beginning a little above the articulation, and extending in a curved direction to a little beyond the median line, and half an inch below the edge of the lower lip. A curved incision was made so as to include, with the first incision, a large cicatrix (the result of the former operation), which adhered closely to the diseased bone. No vessels of any magnitude were divided by these incisions. The fore part of the tumour was exposed to the zygoma. The soft parts were then dissected back, so as to expose the whole of the tumor to the zygoma; the knife was next introduced behind the jaw, near the symphysis; and the soft parts attached to the inner surface of the tumor at its lower part, and to the non-diseased portion of the jaw, were divided. Up to this time, though several vessels were divided, and bled freely for a moment, they soon contracted, so as not to require ligatures; but the last incision, dividing the facial artery and vein, immediately above the submaxillary gland, gave rise to great hemorrhage, which was restrained at first by pressure, and then by ligature. A saw was then applied a little to one side of the symphysis, so as to leave the attachment of the genio-hyo-glossi muscles untouched, and with a pair of strong nippers the bone was divided. The jaw was drawn with some force outwards and downwards; the tem-

poral and masseter muscles were divided; and a portion of the exostosis, which ascended behind the zygomatic process, was cut off with the nippers. The jaw was next everted; turning on the articulation. This was cut through with the external pterygoid muscle, and the remaining soft parts, with the internal pterygoid, were finally divided. Several vessels, though none of large calibre, were secured; the edges of the wound were brought together by sutures, and the patient was placed in bed.

Some degree of bleeding occurred after this formidable operation, but was soon checked. The patient felt low and weak for some time afterwards, but was discharged about the middle of June, as well probably as he would ever be. He could articulate, and bring the remains of the jaw with some force against the upper—but there was a certain amount of facial palsy, and he had also a salivary fistula;—all this suffering, and two severe operations, being the consequences of a badly-performed extraction of a tooth.

Bell, in his work on the “Anatomy, Physiology, and Diseases of the Teeth,” narrates the following cases, which amply testify to the dangers and fearful consequences which may and do follow the incautious and violent extraction of teeth:—

“Mr M., having suffered severely from tooth-ache, requested a young practitioner of his acquaintance to remove the tooth which caused the pain; namely, the second inferior molaris on the

right side. The fulcrum of the instrument was placed on the inner side, and suffered to sink below the alveolar process. After several very violent attempts, the crown of the tooth at length broke, and, at the same moment, a severe crush was felt along the whole inside of the jaw. The roots of the tooth were suffered to remain. A few days afterwards inflammation took place, and at length suppuration followed to a great extent. When I saw him the cheek was greatly enlarged, and the tumefaction extended under the jaw and down the neck. The elevators of the jaw partaking in the inflamed state of the parts, the mouth was with difficulty opened sufficiently for me to see the extent of the mischief which had been produced. I found very extensive ulceration along the inner side of the jaw, from the bicuspidæ to the *dens sapientiæ*; an abscess had formed and burst, and large quantities of pus were constantly pouring from it. The whole teeth occupying the space which I have mentioned were loose, including the roots of the broken one; and upon examining the state of the alveolar process, I found that a large portion had been fractured, and was now exfoliating. The constitution was exceedingly reduced, and it was found necessary to order tonics and the most nourishing food to prevent the patient from sinking. At length the bone became sufficiently loosened to allow of its being detached, and when I removed it, more than two months after the

accident, I found that it was so large as to have included the three molar teeth and both the bicuspid, some of which, having become loose, had previously come away. The part afterwards healed and gradually assumed its natural condition, leaving, however, a deep depression in the cheek. In this case, therefore, five teeth were lost, besides a considerable portion of bone, in consequence of the misapplication of the instrument.

“About two years since, I received into Guy’s Hospital, a man about thirty years of age, who had suffered severely from the extraction of a molaris of the lower jaw on the left side. Extensive abscess had taken place on that side of the face, and at that time there were no less than five openings from which matter was discharging; two of which were in the neck. After some weeks, more than half that side of the lower jaw came away in two or three portions, including the base of the jaw, and extending from the ascending plate forwards.”

Dr. Graves, in his work on *Clinical Medicine*, mentions the case of a man who could not separate the lower from the upper jaw to the distance of more than two lines. He had also intense pain, darting from the angle of the jaw towards the temple, the ear, and the side of the neck. The pain was of an extremely violent character, so as to resemble tic douloureux, the resemblance being still further increased by its being more or

less intermittent. On inquiring into the history of this case, it was found that the patient had some time ago labored under toothache, for which he got the last molar tooth but one of the upper jaw, extracted; and that, immediately afterwards, he was seized with violent pain in the part, and found that he could no longer move his lower jaw as usual. Dr. Graves adds that he has seen many cases of this kind, in which a painful or carious tooth, or an injury done to the gum or jaw, has been followed by violent darting pain in the nerves of the face, simulating *tic douloureux* in many particulars.

“In many cases,” he remarks further, “considerable derangement of the facial nerves is found to follow an injury done to some branch of the dental nerve in drawing a tooth. When the bone has been injured by the force used in extracting the tooth, it frequently happens that if the injury be not quickly repaired, and the parts healed up, symptoms resembling those of *tic douloureux*, or rheumatic neuralgia will supervene, and give the patient a great deal of annoyance. Such was the origin of the mischief in the case before us; the man received an injury of the upper jaw in drawing a tooth, which is not as yet healed, as you may perceive by introducing a probe between the separated portions of gum, when you will find it grate against the rough surface of the bone. In addition to this, there is considerable tenderness of the gum, and swell-

ing of the neighbouring parts, which have extended to the muscles, their sheaths, and finally, to the articulation of the lower jaw."

How many there are, who, from a dread of the pain and injury to the jaw, prefer the misery of keeping in their mouths carious and putrid teeth and stumps, offensive to themselves, and to all who approach them; injuring their healths by the imperfect manner in which their food is masticated, and producing the worst form of indigestion and its consequences.

The extraction of stumps by the ordinary mode of proceeding, is involved in difficulty, is a source of severe pain, is often very protracted, and occasionally cannot be effected. There is a variety of elevators or punches in use for that purpose, and it would almost appear as if the large number of different kinds of instruments which have been invented for their extraction, had been intended to testify to the difficulties of the operation.

Bell recommends the elevator as the most certain and effectual instrument for the removal of the inferior incisors when they are so much crowded as not to allow the application of the forceps. "The alveolar process is to be made the resting place, and the face of the instrument is then to be turned upwards, so as to lift the irregular tooth from its socket. Some degree of lateral pressure upon the next tooth must in many cases, take place during this movement; but if it be performed with proper caution, no injury is to

be apprehended from this circumstance." With the majority of operators serious results would follow, such as splintering the alveolar process, which is made the fulcrum for the instrument, and inflammation, with probable loss of the next tooth, from the pressure to which it is subjected. The external fulcrum will obviate both difficulties.

In using the elevator for the extraction of stumps, its edge is to be inserted between the root and the alveolus, so as to secure a firm hold, and the root is then to be lifted up as it were from the socket, by resting the instrument upon the alveolar process, or even on the side of a neighbouring tooth, as for the extraction of an inferior incisor. Of course the same objections apply to this, as to the preceding operation.

" It has in a very few instances occurred in my practice that the root was so far decayed as to render it impossible to reach it by the elevator, applied in the usual manner. In such cases I have successfully adopted the following method of bringing it away. A crucial incision is made in the gum, as nearly as possible opposite to the apex of the root. The gum is then separated from the bone, so as to expose a very small portion of it, which is to be cut away with the point of a strong knife till an opening is made into the alveolar cavity, and the end of the root is exposed. By placing the point of the elevator between this and the bottom of the socket, the root may be forced out through the natural opening

of the alveolar cavity. In cases of alveolar abscess combined with this state of the root, this plan may be very easily adopted, as the opening in the bone has been already effected for the escape of the pus."—*Bell*.

When it is remembered that this protracted and painful operation is occasionally rendered necessary by the crushing and breaking the tooth by the old method of extracting, some idea may be readily formed of the dangerous consequences which may follow that operation.

Twenty years' practice as a surgeon could not fail to supply me with numerous cases in which the operation of tooth-drawing was required; neither could it fail to inspire me with feelings of sadness at the amount of human suffering and of injury inflicted from the imperfection of our instruments and our modes of operating. These feelings have not been mine alone; I feel persuaded that the majority of my medical brethren have shared them with me, and earnestly wished for some instrument or apparatus to be invented, the employment of which would render the extraction of teeth as satisfactory and as successful as operations are on other parts of the body.

Thus influenced, I was induced to turn my attention particularly to the consideration of the means necessary to effect the object I had in view. A careful study of the anatomy of the parts, *i.e.*, of the teeth and alveolar processes, more especially of the fangs and their respective

directions, led me to adopt the conclusion John Hunter had previously arrived at; namely, that:—"It would be best of all to attempt the extraction of a tooth in the direction of its axis;" and not by means of the lateral motion required with the forceps, nor by the crushing action of the key. One step was thus gained; but had I stopped there, but little had been done. The extraction of a tooth perpendicularly, or in the direction of its axis, although decidedly the best and least painful that can be devised, cannot be adopted with the instruments in ordinary use, unless there be a fulcrum employed external to the mouth. If a tooth be pulled out with the aid of the common tooth forceps, perpendicularly, the body of the instrument must rest on the adjoining teeth, which serve as its *point-d'appui*, and the pressure may, and in all probability will, induce inflammation of the socket, or of its lining membrane, and ultimately, perhaps, even the loss of the tooth.

The next and concluding step, therefore, was to obtain an apparatus which should supply the external fulcrum for the extracting instrument to rest on, while in use—an object so desirable, that several attempts have already been made for its construction, but hitherto unavailingly. My object was, to obtain a fixed fulcrum, external to the mouth, on which, during the extraction of the tooth, the instrument would rest, and thus obviate the difficulties and objections

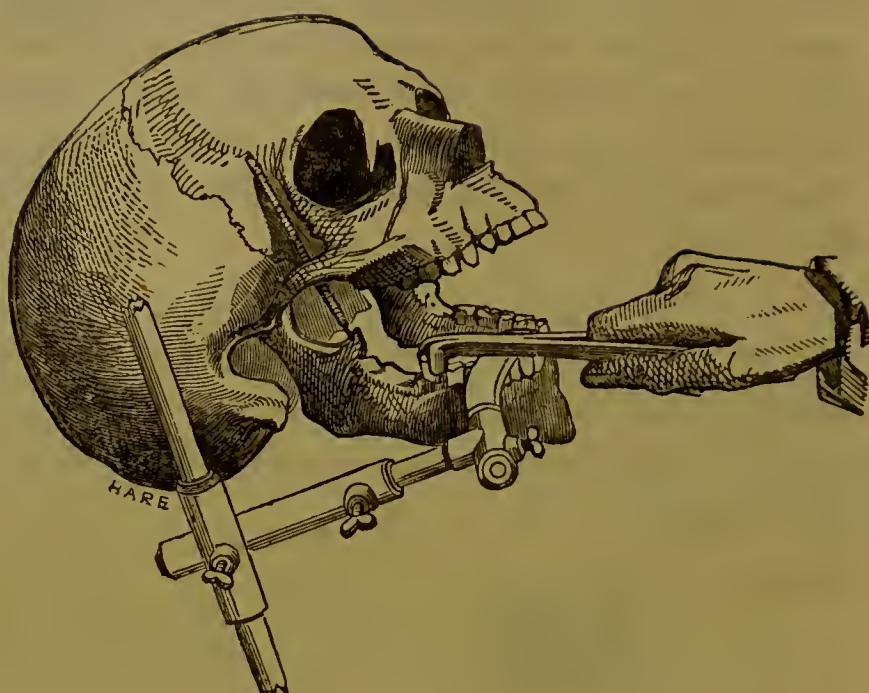
connected with the instruments in general use. The chair which I use, is an ordinary easy chair, with a back that can be inclined to any angle, the top of which is semi-cylindrical, for the reception of, and to enable the operator to come close to, the head of the sufferer. At the right-hand side of this chair there is fixed a strong steel bar or stem, on which again there is a socket capable of sliding on it, and of being fixed at any required height by means of the set-screw, which, on being turned, presses the piece against the stem. The moveable bar, which is thus capable of being raised or lowered at will, holds another piece of steel, or arm, placed horizontally to the chair, which again holds a third piece of metal, the latter being the fulcrum on which the extracting instrument rests.

The teeth are extracted by means of the ordinary forceps, adapted to the fulcrum, in the following manner:—The operator first causes the person to recline back in the chair, and adjusts the bearing, so that it will come between the jaws (when a back-tooth is to be extracted); he then takes hold of the tooth with the forceps, which will rest on the bearing, if a lower tooth is to be extracted, and by moving the forceps upon the bearing as a fulcrum, he lifts the tooth out of the lower jaw. If a tooth is to be extracted from the upper jaw, the forceps are introduced below the bearing, and act so as to draw the

tooth downwards out of the jaw. The bearing and sliding piece should be covered with any soft fabric or substance. By these means teeth can be drawn, in accordance with John Hunter's directions, perpendicularly, or in the direction of their axis.

The chair, itself, with the perpendicular bar and the fulcrum, is represented in one of the accompanying engravings; the other shews the application of the external fulcrum in the extraction of teeth.





The great advantages of this instrument over the present method of extracting are:—

1. Impossibility of fracturing the jaw-bone.
2. The gums cannot be torn or lacerated.
3. The gums are not pressed upon by the instrument.
4. A large amount of pain is consequently saved the patient.
5. The great danger of breaking the diseased tooth avoided.
6. Little or no bleeding takes place after extracting a tooth, and troublesome hemorrhage is thereby avoided.

7. The adjoining teeth cannot be injured, as they are not made the fulcrum for the extracting instrument.

8. The teeth are extracted *perpendicularly*, or in the line of their axis, the instrument being used entirely independent of the gums, teeth, or jaw.

9. The patient is able to masticate his food almost immediately after the operation.

The subject of the second part of the invention is an instrument for drawing out the stumps of teeth; it consists of a fixed and a moveable claw. When in use, the fixed claw rests against one side of the stump, and the moveable claw is pressed by the finger or thumb of the operator against the other side, so as to hold the stump firmly between them; then, the stem of the instrument resting against the fixed bearing, the operator can readily extract the stump. This instrument is very similar in respect to the moveable claw, to what has before been used, and is commonly called the key instrument, but in that there was no fixed claw used in such a manner as to hold the stump between two claws, as in the present instrument. Stumps of teeth, however deeply embedded in the jaw or gum, which have hitherto been the opprobrium of the Dentist's art, can be extracted with the greatest ease and safety.

The objections so lucidly stated by that learned physician, Dr. Arnott, to the use of the key in-

strument, it will be observed, are obviated by the employment of the fulcrum, and the extraction of teeth perpendicularly to the axis. If a firm hold be taken of the tooth to be removed, and it be drawn directly upwards or downwards, it can neither be broken, nor the jaw-bone splintered, unless ossification have taken place, uniting the tooth to the socket, in which case the tooth may be broken, but no further mischief can be done. It is equally impossible to draw two teeth at once, in consequence of their being too close together, this accident depending on the lateral inclination given to the instrument. Neither does the tearing or lacerating the gum take place during this operation, if the soft parts be freely separated from the neck of the tooth previously to the operation.

Those of my patients who have had teeth extracted by means of my patent instrument, and by the old method, all affirm that the pain is incalculably less, and that they have been able to use the jaw with comfort a few hours afterwards; and that for the best of all reasons, because the gums are not bruised or lacerated, nor the jaw injured.